



CHALLENGE TITLE	
M1: Optimization of Flotation and Leaching to Reduce Waste and Inputs	
MACRO-AREA	
Mining with Less Waste	
PROBLEM/GAP	
Flotation and leaching processes in mining present a critical efficiency gap, as they generate high volumes of tailings and consume large amounts of water, energy, and reagents; furthermore, their performance is affected by mineralogical variability and lack of online control, which limits the recovery of valuable minerals and increases costs and environmental impacts.	
CHALLENGE DESCRIPTION	
Flotation and leaching processes are fundamental for mineral recovery, but they also represent a significant source of waste generation and consumption of water, energy, and reagents. The limited efficiency of these processes directly impacts the sustainability and competitiveness of mining operations. This challenge seeks to promote technologies that improve metallurgical efficiency, reducing waste generation and the use of critical inputs. Solutions that integrate online control, selective reagents, and more sustainable process designs will be prioritized, enabling cleaner, more efficient, and resilient mining.	
GENERAL OBJECTIVE	
To contribute to the sustainability of metallurgical processes through the development and validation of technologies that optimize flotation and leaching, reducing waste and critical inputs such as water, energy, and reagents.	
SPECIFIC OBJECTIVES	
1.	Co-develop flotation and leaching technologies that improve metallurgical recovery with less waste generation.
2.	Design online control systems to optimize operational conditions in real time.
3.	Validate the use of selective reagents and low-environmental-impact formulations.
4.	Execute pilots to measure technical, water, energy, and environmental efficiency.
5.	Generate technical guidelines and operation protocols for the adoption of the platform at mining sites.
EXPECTED RESULTS	
1. Technical reports with validation results of optimized flotation and leaching technologies. 2. Indicators of waste reduction, water, energy, and reagent consumption. 3. Demonstrative pilots of online control systems and selective reagents in semi-industrial and operational environments. 4. Technical guidelines document for industrial adoption.	
SCOPE	
Includes: - Technologies with TRL ≥ 4 applicable to flotation and leaching. - Demonstrations in controlled relevant environments, piloting, and semi-	

industrial and operational validation.

- Assessment of technical, metallurgical, water, energy, and environmental performance.
- Integration studies with process control and environmental management systems.

Excludes:

- Proofs of concept and/or laboratory-scale tests TRL < 4.
- Solutions that pose additional risks to worker safety, equipment, or the environment.
- Technologies that increase the consumption of strategic resources such as water or energy.
- Interventions that negatively interfere with the continuity of the production process.

KEY PERFORMANCE INDICATORS (KPIs)

1.	Improvement in metallurgical recovery (%).
2.	Reduction of waste generated per ton processed (%).
3.	Reduction of water, energy, and reagent consumption (%).
4.	Precision and stability of the online control system (% of time under optimal conditions).

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Infrastructure for optimized flotation and leaching pilot testing.
- Generation of validation and technological certification protocols for metallurgical efficiency.
- Training and operation protocols associated with the use of the technology.
- Capacity building in the integration of online control, selective reagents, and sustainable process design.

INDUSTRY AFFECTED BY THE CHALLENGE

Mining processes.